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(54) GRAPHITE ELECTRODE

(71) We, C. CONRADTY, of Postfach 480, 8500 Nürnberg 1, Federal Republic of Germany, a Company of the Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is concerned with a section, provided with a screwthreaded socket to receive a nipple, of a graphite electrode for arc furnaces with an oxidation-resistant protective coating, which coating has a higher specific conductance than graphite.

Electrodes of this type have been described, for example, in Federal Republic of Germany Patent Specification No. 2,040,511 and in British Patent Specification No. 1,026,055. The protective coating reduces the oxidation of the electrode graphite to a small amount. By using coated electrodes instead of uncoated electrodes, it is possible to operate arc furnaces with electrodes of smaller diameter and to achieve overall a considerable reduction in the electrode consumption per ton of steel produced in the arc furnaces.

The protective coatings which are employed technically nowadays also possess a very good electric conductivity. The total ohmic resistance of the coated electrode at ambient temperature is approximately half as great as that of the uncoated electrode. Thus, the electrode can also be considerably more heavily loaded electrically, because approximately 40% of the current flows in the almost metallically conductive protective coating.

For example, an uncoated graphite electrode of 45.7 cm. diameter can be loaded with 44,000 A, i.e. 26.8 A/cm², which corresponds to the conditions of "ultra high power" operation. With a coated electrode, on the other hand, under the same conditions the graphite is only subjected to a load of 18.3 A/cm², i.e. as in normal operation.

Electrical overloading of the graphite is disadvantageous due to overheating of the electrode and hence intensified oxidation and premature attainment of the thermo-mechanical load limit. Cracks and fractures are the result.

However, it is noticeable, when using coated graphite electrodes in arc funaces, that serious difficulties arise in the region of the joints between the electrode sections, which manifest themselves as an increased rate of fracture of the screwthreaded sockets of the electrodes.

We have now found that the cause of these socket fractures in the case of graphite electrodes provided with a protective coating is due to the fact that the protective coating is interrupted at the joints between the electrode sections, so that the current there flows through the electrode graphite, causing the joint to become over-loaded and resulting in cracking and peeling in the sockets. On the electrode and faces in close contact, a current loading of approximately 40—42 A/cm² occurs.

It is, therefore, an object of the present invention to eliminate the cause to these cracks and fractures of the electrode sockets by reducing the current density in the graphite in the region of the nipple joint.

Thus, according to the present invention, there is provided a section, provided with a screwthreaded socket to receive a nipple, of a graphite electrode for arc furnaces with an oxidation-resistant protective coating, which coating has a higher specific conductance than graphite, wherein, apart from the screwthreaded socket, the protective coating covers the whole of the surface of the section, including the end faces thereof.

Since many coatings become viscously plastic above 600°C. and particularly above about 800°C. (cf. Federal Republic of Germany Patent Specification No.

1,615,404), an almost ideal electric contact is obtained between the end faces of the sections, so that the current now mainly flows, without difficulty, through the protective coating of the electrodes, even at the joints of the electrodes.

In the case of electrodes provided with sheet metal covers, even apart from self-baking electrodes, it is known to weld together the sheet metal covers at the joints of the electrode sections (see French Patent Specification No. 977,067). It is also known to protect the surface of electrodes against oxidation by impregnation instead of by coating. However, by this means, the current load capacity of the electrode is not increased as much as it is by providing an appropriate coating of good conductivity. If the impregnation is performed by dipping or with vacuum and pressure (see German Democratic Republic Patent Specification No. 92,093), then it automatically extends over the entire surface of the electrode sections. Finally, it is known (see Federal Republic of Germany Patent Specification No. 1,790,172) to provide hollow electrodes with a coating in order to improve their gas-tightness and simultaneously to provide sealing rings made of the material of the coating at the end faces of the electrode sections.

Protective coating made of aluminium alloys have been found to be particularly suitable. Such coatings consist of approximately 60—75% aluminium and also aluminium oxide, silicon carbide and certain other minor additions.

The resistance of the protective coating is preferably as low as possible, a specific electrical resistance of 0.07—0.10 $\Omega/mm^2/m$ having been found to be suitable.

We have also found that it is preferable for the specific conductance of the protective coating to be greater than that of the graphite.

The accompanying drawing illustrates one embodiment of the present invention: a graphite electrode section (1), shown in partial section, is provided with a protective coating (2) which, according to the present invention, apart from the screwthreaded socket (3), covers the whole of the surface of the electrode section, including the end faces thereof.

WHAT WE CLAIM IS:—

1. A section, provided with a screwthreaded socket to receive a nipple, of a graphite electrode for arc furnaces with an oxidation-resistant protective coating, which coating has a higher specific conductance than graphite, wherein, apart from the screwthreaded socket, the protective coating covers the whole surface of the section, including the end faces thereof.

2. A section according to claim 1, wherein the protective coating consists mainly of aluminium, together with minor amounts of oxides and carbides.

3. A section according to claim 1 or 2, wherein the protective coating has a specific electrical resistance of 0.07—0.10 $\Omega/mm^2/m$.

4. A section according to any of the preceding claims, wherein the specific conductance of the protective coating is greater than that of the graphite.

5. A section according to claim 1, substantially as hereinbefore described and with reference to the accompanying drawing.

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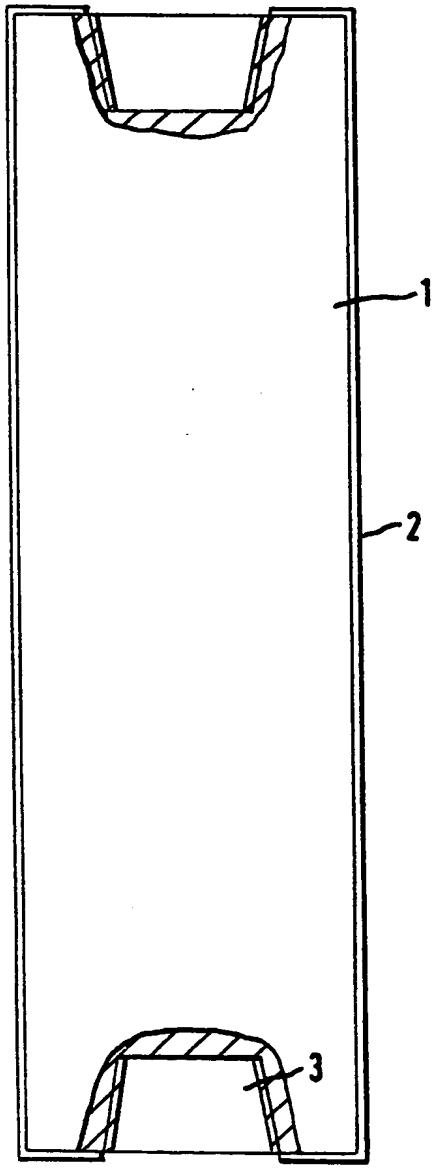
COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.



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